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ABSTRACT

Several tests from the Educational Testing Service (ETS) have been used or are candidates for use by the Tennessee State Department of Education as initial licensure endorsement area tests. Memphis State University conducted a study in 1991 to recommend minimum qualifying scores for endorsement area applicants who would take the applicable tests. The statewide study involved personnel from 39 public education agencies and 34 higher education institutions with professional preparation programs in these specialized areas. The four tests evaluated were: (1) Education in the Elementary School; (2) English Language and Literature; (3) Social Studies; and (4) Spanish. A Knowledge Estimation Panel was formed with a minimum of 30 members for each test (panels ranged from 33 to 39 members, for a total of 140), and judgments were made on each test question by panel members using a 9-point scale. Twelve educational and lay representatives served on a standards committee that reviewed panel findings and made recommendations about minimum qualifying scores. Five tables present study findings, with the recommended scores for the four tests reviewed in 1991 and the seven tests validated earlier. A seven-item list of references is included. (SLD)

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FORMULATION OF RECOMMENDED PERFORMANCE STANDARDS ON VALIDATED ETS SUBJECT-MATTER TESTS FOR INITIAL TEACHER LICENSURE IN TENNESSEE

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Introduction

Statutory requirements for the use of tests in the initial licensure/certification and endorsement of public school personnel in Tennessee were established by the Comprehensive Education Reform Act of 1984. The legislation mandated that applicants for initial certification must present minimum qualifying scores on secured tests of communication skills, general knowledge, professional knowledge, and endorsement area specializations. The act stipulated that the requirements would become effective July 1, 1984, or as soon thereafter as the tests could be validated and have minimum qualifying scores established.

A statewide study conducted in 1984 determined that the three National Teacher Examinations (NTE) Core Battery tests and 23 of the 25 NTE Specialty Area Tests were valid to use as initial certification tests in Tennessee. The study also provided the data to establish minimum qualifying scores for the valid tests. Upon completion of the study, the Tennessee State Board of Education (TSBE) immediately established minimum score requirements for the NTE Core Battery covering communication skills, general knowledge, and professional knowledge. Subsequently, the TSBE instituted minimum score requirements as recommmended for NTE Specialty Area tests that correspond to 14 endorsement areas.

Several tests available from Educational Testing Service (ETS), Princeton, NJ, have been used or are candidates for use by the Tennessee State Department of Education as initial licensure endorsement area tests. The Tennessee State Department of Education obtained the services of Memphis State University to conduct a study of selected tests during the spring of 1991 to recommend minimum qualifying scores for endorsement area applicants who would take the applicable tests. The statewide study involved personnel from 39 public education agencies and 34 higher education institutions with professional preparation programs in these specialized areas.

Objectives of the Study

The study conducted for the Tennessee State Department of Education by Memphis State University had two objectives. They were (1) to determine the knowledge estimation of four NTE tests for specific initial certification endorsements of public school personnel in Tennessee, and

(2) to formulate recommendations on minimum qualifying scores for these tests plus seven other ETS tests for use in Tennessee. The study was delimited to potential use of the tests for initial certification endorsement rather than to select personnel for employment.

Description of Candidate Tests

All four of the tests included in data collection for the knowledge estimation task in 1991 were instruments that were constructed by Educational Testing Service, which is a private, non-profit testing organization: Education in the Elementary School, English Language and Literature, Social Studies, and Spanish.

Methodology

The design and procedures used in the study represent essentially a replication of comparable studies of ETS/NTE tests conducted by ETS (Faggen, 1983) and Memphis State University (Bowman, Bowyer, Petry, Rakow, Nothern, & Jacobs, 1984; Bowman, Petry, Emanuel, & Bellott, 1988; Bowman, Petry, Rakow, Douzenis, & Emanuel, 1989; and Bowman, Petry, Rakow, & Emanuel, 1990). This section of the report presents the rationale for the design and procedures, the panel function, the selection of participants, the Standards Committee function, organization of the panel, formation of the panel, preparation for panel meetings, the data collection procedures, selection and meeting of the Standards Committee, and the data on panel responses.

Rationale for the Methodology

The literature on standard-setting for certification examinations does not demonstrate a singular appropriate or clearly superior methodology. The use of professional judgment under relatively controlled conditions as employed in this study complies with accepted measurement principles and has been widely utilized in similar studies. The procedures used in making judgments deal with standard setting (judgments about levels of test performance necessary for persons who are minimally qualified in specialized areas). Consequently, the methods used in

the study required the estimation of the minimum qualifying score for certification and endorsement.

The estimation of performance levels expected of minimally qualified applicants for certification and endorsement necessitated a broad-based familiarity with the responsibilities of professional public education personnel in Tennessee. These requirements were addressed by systematically collecting and analyzing the judgments of representative groups of professional educators with appropriate experiences in local school districts and higher education institutions. (The nomination and selection procedures for participants are described below.)

The study participants were assigned a specific function to be performed - knowledge estimation. Personnel who were knowledgeable with respect to preparation of professional public school specialists in each of the specialized areas and practitioners in the specialized area participated in the knowledge estimation activities. An independent committee utilized the results from the knowledge estimation to make recommendations on minimum qualifying scores.

Human judgment by professional educators was unquestionably the foundation of the study. While judgments by professionals are an integral part of all research, such judgments were used to generate the raw data that were analyzed statistically in this study. This strategy for data collection was necessary to provide information needed by the Tennessee State Department of Education to determine the minimum qualifying scores of the tests in the initial certification and endorsement process. The alternative strategies available and described in the literature were inadequate because they do not encompass all functions required for standard setting.

In establishing minimum score requirements, the Standards for Educational and Psychological Tests states, "If specific cutting scores are to be used as a basis for decisions, a test user should have a rationale, justification, or explanation of the cutting score adopted" (APA, p 66). The rationale for the recommendations on minimum qualifying scores derived in this study is that the scores must be based on the collective judgments of representative experts. The personnel who performed the knowledge estimation function were qualified experts from local

school districts and professional preparatory higher education institutions throughout Tennessee. Their combined judgments constituted the basis for determining the minimum scores on knowledge and academic skills required for initial certification and endorsement of professional public education personnel in Tennessee.

The strategy used in the study required that the judgments of individuals from local school districts and professional preparatory higher education institutions would be combined on a statewide basis to determine the estimated performance levels of minimally qualified personnel for each of the tests. As a consequence, two factors may produce differential effects for the graduates of different institutions: (1) the use of data for the state as a whole and (2) the use of an approved program procedure to offer specialized preparation programs at specific higher education institutions. Variability in the course content and grading practices are likely across institutions offering approved programs in the same specialization. Therefore, graduates of different institutions may be unequally affected by statewide standards.

Panel Function

The function performed in the review of the tests was conceptualized as a panel activity. The panel was utilized to perform the knowledge estimation function for each test. The activity of the panel is described below. A panel consisted of all persons involved with any one test at any of the seven locations where data collection was held.

The members of the Knowledge Estimation Panel for each test performed a single task in making judgments about performance levels of minimally qualified personnel who are beginning professional public educators in Tennessee. The steps involved in preparing for the task and making the judgments are described below.

Each panelist was required to conceptualize a hypothetical reference group of only those college graduates who are likely to pursue professional education careers in the elementary or secondary grades, excluding persons who are likely to pursue advanced study or non-teaching careers. Next, the panel member was instructed to consider only those graduates who are

minimally qualified as beginning professional educators in Tennessee (i.e., those who have the minimum knowledge and academic skills for competent performance). Since teachers are thoroughly experienced in using this concept, they are likely to perform conscientiously and well in defining minimal competence because of the consequences of making incorrect judgments with regard to individuals.

Each panel member was directed to make estimates about knowledge as opposed to correct responses that would include guessing correctly. An exercise was used at the meeting to assist the panelists in forming the appropriate reference group and making judgments about knowledge levels. In advance of the panel meeting, the panelist was encouraged to obtain information locally about the relevant curriculum and professional preparation program.

Judgments were made on each test question by the panel member using a 9-point numerical response scale (10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, and 90%). The score points were not described verbally for two reasons: (1) to avoid influencing the judgments made and (2) to utilize the familiar and widely-used numerical basis for judging test performance.

Standards Committee Function

The Standards Committee was responsible for performing one function: to develop recommendations on minimum qualifying scores for the four tests and for seven tests for which, in previous years, there were not enough tests administered to enable norms (mean, standard deviation, and standard error of measurement) to be set (Chemistry, Physics, Teaching Hearing Impaired Students, Psychology, Earth/Space Science, Health Education and Marketing Education).

The first step in developing recommendations on minimum qualifying scores was the presentation to the Standards Committee of the data that were derived from the Knowledge Estimation Panel for each ETS test. These data consisted of estimated scores of persons who, based on the judgments of the panelists, are minimally qualified for initial certification and endorsement as beginning professional specialists in Tennessee.

The committee received summative data derived from the results of administering the tests to examinees. The databases for the eleven ETS tests were sufficiently large to provide normative information that included the standard error of measurement (a quantitative measure of test score precision).

Organization of the Panels

In this study, a panel was defined as a group of experts assigned to perform a specific function for each test. Since the panel members made independent judgments on the tests, the panels did not actually convene as groups to perform their respective functions.

Whereas all tests included in the study were designed for specialized professional areas, the target numbers of panelists specified for the knowledge estimation panel were the same across all tests. The desired size of a panel for each test was 30 for each of the four tests for which data were gathered this year.

Formation of the Panels

The nomination and selection of panelists utilized procedures that gave attention to expert qualifications, representation of gender groups, inclusion of significant racial/ethnic group members, and diversity of higher education institutions and local school districts in Tennessee. The nomination of panel members was initiated by a letter of request from the project. This letter, plus instructions for nominating panel members and nomination forms, were sent to the teacher education units with preparation programs for the specialized areas and to all of the local school districts in Tennessee.

The instructions for nominating panel members provided background information on the study. The criteria for panel member eligibility stated in the instructions were the following:

(1) currently serving in the public schools in the area for which nominated or currently serving as a faculty member in a college or university offering one or more approved teacher education programs

(2) a minimum of two years of experience as defined above

(3) certification in the appropriate area for public school nominees

The eligibility of nominees to serve on the panels for which they were nominated was ascertained based on congruence between the stated criteria and the nomination form data. The selection of panelists from the pool of qualified nominees for each panel was made to ensure that the factors identified above were addressed to the maximum extent possible.

Preparation for Panel Meetings

In advance of the panel meetings, the panelists were sent preliminary materials related to their tasks. The materials for the knowledge estimation function included an overview of the task, the instructions for performing the task, a copy of the appropriate response form, and a description of the test content. Knowledge Estimation Panel members participated in an orientation exercise that was designed to provide training in the maintenance of consistent standards when making judgments about questions with different levels of difficulty. Sample questions from ETS tests were presented with two estimated percentages of examinees who would know the correct answer. The actual percentages were used for a national sample of ETS examinees representing the second and fourth quintiles on the total test score distribution. These two quintiles were used to avoid influencing the panelists unduly when they made actual estimates later. Between the presentation on the questions and the percentages, the panelists made estimates of the percentage of examinees in each quintile who would know the correct answer. The panel members also made estimates of the percentage of minimally qualified examinees who would know the correct answer to each sample question.

One edition of each ETS test was used in the study. Because the ETS tests are secured, the preparation of the test materials was performed by ETS personnel. Within each test, the items were grouped by content topic in order to facilitate the work of the panelists. The correct answer for each test question was marked on the test reviewed by each panel. The numbers of test questions reviewed were 150 for the Education in the Elementary School, English Language and Literature, and Social Studies tests, and 160 for the Spanish test.

Data Collection

The data collection was conducted at successive meetings in Chattanooga, Johnson City, Knoxville, Cookeville, Nashville, Jackson, and Memphis in February and March, 1991. Personnel from Memphis State University made the arrangements for the facilities and handled matters related to travel by the panelists. ETS personnel who work with their testing programs and have participated previously in any similar studies conducted the data collection session. Staff from Memphis State University assisted in the data collection meetings. A general orientation was conducted on the background of the study and the task to be performed by all participants.

Selection and Meeting of Standards Committee

A group of 12 educational and lay representatives was selected by Memphis State University personnel to serve as the Standards Committee for the study. In determining the composition of the committee, attention was given to several factors: geographic distribution; representation of males and females; representation of racial/ethnic groups; and representation of higher education institutions, local school districts, and the general public.

The Standards Committee met in Nashville on May 15, 1991. The committee developed recommendations on minimum qualifying scores for the valid tests based on a review of the knowledge estimation data and data available on examinee performance. Personnel involved in conducting the study served as staff and resource persons for the committee. Personnel from the Tennessee State Department of Education and the Tennessee State Board of Education were observers.

Data on Panel Responses

Data analyses were performed for the responses by the Knowledge Estimation Panel. The knowledge estimation function focused on the percentage of minimally qualified applicants for certification and endorsement in Tennessee who would know the answer to each question. Specified response choices were 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, and 90%. The analysis

was made by calculating the mean percentage for each question based on the percentages chosen by the panelists. (Omissions and "Do Not Know" responses were disregarded.) The mean percentage for each question was adjusted upward by adding the percentage of respondents who would not know the answer but would guess correctly. When divided by 100, the sum of the adjusted mean percentages for all questions on a test was derived to provide an estimated raw score mean for minimally qualified applicants.

Since the ETS tests are normative instruments, scaled scores must be derived for the raw scores. A linear equation consisting of two numerical values for each test is used to compute the scaled score for each test. The scaled score is derived by adding a specified numerical value to the product of the raw score and a conversion factor for the score. The conversion parameters provided by ETS were used to obtain the scaled score mean on all of the tests. For each test, the report presents the adjusted raw score mean and the scaled score mean derived from the data collected in the study.

Presentation of Data and Results

In this section, the data are summarized for the personnel involved and the responses of the panels. The results of the deliberations by the Standards Committee are also presented.

Data on Personnel

Background data on the 1991 panel members are reported in Table 1 for the 140 participants. With respect to gender, almost three-fifths of the knowledge estimation panelists were females; when classified by ethnicity, the ratio of blacks to whites was 1 to 13.5. Demographic data on the 12 Standards Committee members are also presented in Table 1. With regard to gender, slightly more than one half (7) of the committee members were females; when classified by ethnicity, one third of the committee members (4) were black, two thirds (8) were white.

Table 1

FREQUENCY AND PERCENTAGE DISTRIBUTIONS OF PANELISTS AND STANDARDS COMMITTEE MEMBERS BY GENDER AND ETHNICITY

	Gender						
	Male		Female		No response		Total
Function	f	%	f	%	f	%	
Knowledge Estimation Panel	60	42.9	80	57.1	0	0	140
Standards Committee	5	41.7	7	58.3	0	0	12

	Ethnicity						
	Black		White		Other		Total
Function	f	%	f	%	f	%	
Knowledge Estimation Panel	9	6.4	122	87.2	9	6.4	140
Standards Committee	4	33.3	8	66.7	0	0	12

Table 2 shows the number of 1991 participants in the knowledge estimation process from colleges and universities and school districts by test name. A minimum of 30 participants for each test was sought and achieved. The total numbers ranged from 33 each for the Social Studies test to 39 for the Education in the Elementary School test.

Table 2

NUMBER OF PARTICIPANTS FROM COLLEGES/UNIVERSITIES AND SCHOOL DISTRICTS BY TYPE OF TEST FOR THE KNOWLEDGE ESTIMATION FUNCTION

Test Name	Number of Participants		
	Colleges/ Universities	School Districts	Total Number of Participants
Education in the Elementary School	23	16	39
English Language and Literature	19	15	34
Social Studies	16	17	33
Spanish	17	17	34
Total	75	65	140

Table 3 contains a summary of analyses on estimated scores for each test. They include the raw score mean and the scaled score mean. Also included are total items and number of scored items by test. Results are presented for the four tests included in the 1991 data collection as well as the seven tests for which data had been collected when validated earlier.

Knowledge Estimation Panel Results

The members of the Knowledge Estimation Panel for each test made judgments independently on the percentage of minimally qualified applicants for certification and endorsement in Tennessee who would know the answer to each question. Based on the response choices (10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, and 90%) selected, the mean percentage for each question was computed and adjusted upward to account for guessing the correct answer if unknown to the examinee. The sum of the adjusted percentages represented the estimated raw

Table 3

SUMMARY OF ANALYSES ON ESTIMATED SCORES FOR MINIMALLY QUALIFIED CERTIFICATION CANDIDATES BY TEST

Test (number and name)		Items	Mean		N
		Total/Scored	Raw Score	Scaled Score	
01	Education in the Elementary School	150/149	76.638	518.676	39
04	English Language and Literature	150/150	81.773	532.223	34
08	Social Studies	150/149	76.177	560.480	33
19	Spanish	160/159	87.620	514.712	34
24	Chemistry	120/120	52.602	458.556	18
26	Physics	120/119	53.457	547.478	20
27	Teaching Hearing Impaired Students	120/120	66.175	531.364	18
39	Psychology	120/120	57.533	464.147	18
53	Earth/Space Science	120/116	56.892	504.139	19
55	Health Education	120/119	60.494	491.914	22
56	Marketing Education	120/120	69.459	556.902	19

score mean for the test. The raw score mean was converted to a scaled score mean using conversion parameters provided.

The scaled scores for each ETS subject-matter test can vary from a low of 250 to a high of 990, a 740-point difference between the lowest and highest scores possible. Scores cannot be compared directly among the subject-matter tests for two reasons: first, the tests are normed independently on different groups of examinees; second, the standard errors of measurement, an index of the precision of test scores, vary to a considerable degree among the tests.

Standards Committee Actions

The Standards Committee elected one of its members to serve as chair during the deliberations in order to take the formal actions required. The decisions on recommendations of minimum qualifying scores and related matters are reported below. The Standards Committee received the results of the knowledge estimation function for minimally qualified professional practitioners based on the judgments of the panel members who reviewed the 11 tests. Table 4 includes the normative and derived data on the 11 ETS Specialty Area Tests, which were the following: items, total and scored; number of examinees; scaled score mean; standard deviation; standard error of measurement; and knowledge estimation scaled score mean. In addition, the values for scaled score means minus 1, 2, 3, and 4 standard errors of measurement were derived. Data were also available on score distributions of examinees for the 11 tests for consideration by the committee. After a thorough review of the examinee performance data, the committee recommended specific minimum qualifying scores for the 11 tests. They are depicted in Table 5.

Conclusion

The actions of the Tennessee State Board of Education relating to the recommendations made by the Standards Committee are of interest and significance for personnel from teacher preparation institutions and students who will take the tests. Its action represents an opportunity to adjust licensure score requirements for four of the tests considered in this project in order to reflect curricular offerings of institutions involved in preparing teachers for classroom instructional

Table 4

NORMATIVE AND DERIVED DATA ON NTE SPECIALTY AREA TESTS

	Name and Number of Test					
	Education in Elementary School (1)	English Language and Literature (4)	Social Studies (8)	Spanish (19)	Chemistry (24)	Physics (26)
Items						
Total/Scored	150/149	150/150	150/149	160/159	120/120	120/119
Norms						
N	55,475	10,711	12,125	2,420	591	223
Mean	619	597	604	591	519	533
S.D.	73	78	80	85	109	117
S.E.M.	21	20	22	21	34	37
Knowledge Estimation Mean	519	532	560	515	459	547
Mean -						
1 S.E.M.	498	512	538	494	425	510
2 S.E.M.	477	492	516	473	391	473
3 S.E.M.	456	472	494	452	357	436
4 S.E.M.	435	452	472	431	323	399

Table 4 (Continued)

NORMATIVE AND DERIVED DATA ON NTE SPECIALTY AREA TESTS

	Name and Number of Test				
	Teaching Hearing Impaired (27)	Psychology (39)	Earth/ Space Science (53)	Health Education (55)	Marketing Education (56)
Items					
Total/Scored	120/120	120/120	120/116	120/119	120/120
Norms					
N	121	111	214	500	107
Mean	660	634	593	671	634
S.D.	73	110	110	97	89
S.E.M.	34	36	34	32	35
Knowledge Estimation Mean	531	464	504	492	557
Mean -					
1 S.E.M.	497	428	470	460	522
2 S.E.M.	463	392	436	428	487
3 S.E.M.	429	356	402	396	452
4 S.E.M.	395	320	368	364	417

Table 5

COMMITTEE RECOMMENDATIONS ON MINIMUM QUALIFYING SCORES FOR VALID TESTS TO BE USED IN TENNESSEE

Test Name	Suggested Score
Education in the Elementary School	520
English Language and Literature	510
Social Studies	520
Spanish	490
Chemistry	400
Physics	400
Teaching Hearing Impaired Students	530
Psychology	460
Earth/Space Science	470
Health Education	510
Marketing Education	560

responsibilities in those respective subject areas. Increasing required scores reflects higher levels of accomplishment by Tennessee teacher education graduates and a stronger relationship with national norms, but necessitates avoiding an adverse effect on minority candidates. Among the seven tests for which national norms have been established only recently, the minimum scores recommended will serve as a beginning point for licensure considerations.

A concern of professional educators is to conduct periodic review of all tests required for licensure in Tennessee, to ensure that the most recently created and revised tests are analyzed from the viewpoints of job relevance in K-12 schools and content correlation with college programs

of study. Inasmuch as the contents of the tests are continually modified, changes in test items are made periodically, resulting in new versions of the tests. An on-going program of review will produce new sets of data on which to base recommendations of minimal scores for new and revised instruments. Any consideration of changes in minimum scores will necessitate an analysis of the tests for validity purposes and for knowledge estimation reasons.

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